SOV/56-35-2-37/60

10 (7)

AUTHOR: Stanyukovich, K. P.

TITLE: The Shock Waves in a Conducting Ultrarelativistic Gas (Udarnyye volny v provodyashchem ul'trarelyativistskom gaze)

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1958, Vol 35, Nr 1 (7), pp 520-521 (USSR)

ABSTRACT: First, equations are given for the conservation of certain quantities in the transition of the flow of a conducting gas through the front of a straight shock wave. These equations are specialized for the ultrarelativistic case and the pressure and the specific volume are eliminated from these equations. First, a trivial solution is obtained which may be applied to a photon gas which has the same equation of state as an ultrarelativistic gas. In these cases there is no shock wave. Also the other possible solutions (without and with shock waves) are mentioned. An expression is given for the velocity of the gas behind the front of the shock wave. There cannot be a shock wave when the flowing velocity of the gas behind the front of this shock wave is equal to the velocity of light for

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The Shock Waves in a Conducting Ultrarelativistic Gas

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particles with non-zero mass. The velocity of light can therefore not be attained. At a certain velocity the amplitude of the shock wave has a maximum. By a further increase of velocity part of the energy of the particles is converted into radiation energy, pairs begin to be produced in the photon gas, and the temperature of the shock wave will decrease. There are 2 references, 2 of which are Soviet.

ASSOCIATION: Vyssheye tekhnicheskoye uchilishche im. Baumana (Technical University imeni Bauman)

SUBMITTED: April 19, 1958

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STANYUKOVICH, K.P.

Shock waves in a conducting ultrarelativistic gas. Zhur. eksp. i teor. fiz. 35 no.2:520-521 Ag '58. (MIRA 11:10)

1. Vyssheye tekhnicheskoye uchilishche imeni Baumana.
(Shock waves)

SOV/56-35-3-30/61

10(4), 10(7)

AUTHOR: Stanyukovich, K. P.

TITLE: Some Steady Relativistic Motions of a Gas in a Conductive Medium (Nekotoryye statsionarnyye relyativistskiye dvizheniya gaza v provodyashchey srede)

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1958, Vol 35, Nr 3, pp 762-765 (USSR)

ABSTRACT: The author of the present paper investigates quasi-onedimensional relativistic steady gas flows in a medium of infinite conductivity; it is further assumed that a magnetic field H exists in which $\vec{H}$ is supposed to be vertical to the velocity of flow $\vec{a}$. For the investigated flows cylinder symmetry and adiabatic conditions apply. The following basic equations (Ref 1) serve as a basis: $w^*/\Theta = w_o^* = \text{const}$; $\Delta s a/\Theta V = \Delta \dot{M} = \text{const}$; $\Theta = (1 - a^2/c^2)^{1/2}$; $w^* = pV + \varrho V c^2 + \mu H^2 V/4\pi$, where w_o^* denotes the rest enthalpy, p - pressure, V the specific volume, ϱ - the density of the medium, and $\Delta\dot{M}$ the rate of flow of the mass of gas (per second) through the surface Δs(the size of the sur-

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face through which the constant mass $\Delta\dot{M}$ flows depends on r). Cylinder symmetry is introduced by: $s = 2\pi r$; $\dot{M} = 2\pi ra/\Theta V$; $HV = br$. Equations are deduced for the total momentum (equal to the "reactive" force) that an expanding gas can aquire (both in the presence and in the absence of a field):

$$\Delta F = \Delta\dot{J} = \Delta s\left[\frac{a^2}{c^2\theta^2}\left(p + \varrho c^2 + \frac{\mu H^2}{4\pi}\right) + p + \frac{\mu H^2}{4\pi}\right]$$

or $$\Delta F = a\Delta\dot{M}\left[\frac{w_o^*}{c^2} + \frac{\Theta}{a^2}\left(pV + b_o/2V\right)\right].$$

For a nonrelativistic gas ($\alpha = 1$, $\varrho_o V_o = 1$, $p \to 0$, $V \to \infty$, $pV = 0$) it holds that $\Delta E_\infty = \Delta\dot{M}c\left[\left(1 + kAV_o^{1-k}/(k-1)c^2 + b_o V_o^{-1}/c^2\right)^2 - 1\right]^{1/2}$. In the classical limiting case it holds that $\Delta F = \Delta\dot{M}a\left[1 + a^{-2}\left(AV^{1-k} + b_o/2V\right)\right]$; with $V \to \infty$:

$$\Delta F_\infty = \Delta\dot{M}a_\infty = \Delta\dot{M}\left[2kp_o/(k-1)\varrho_o + 2b_o\varrho_o\right]^{1/2}.$$

Some Steady Relativistic Motions of a Gas in a Conductive Medium

Finally, the ultrarelativistic case is dealt with ($\alpha = 0$, $p_0 = (k-1)\varrho_0 c^2$):

$$\Delta F = \Delta \dot{M} c \left[\left(\frac{a}{c} + (k-1)\frac{c}{a}\right)\left(\varrho_0 V_0 + \frac{b_0}{kc^2 V_0}\right) + \frac{2-k}{2k}\,\frac{b_0 \Theta}{caV(a)} \right]$$

and in the case of the absence of a field ($b_0 = 0$):

$$\Delta F = \Delta \dot{M} c \left[a/c + (k-1)c/a \right] \varrho_0 V_0 .$$

There is 1 reference, which is Soviet.

ASSOCIATION: Moskovskoye vyssheye tekhnicheskoye uchilishche im. Baumana (Moscow Higher Technical School imeni Bauman)

SUBMITTED: April 19, 1958

If thermal conductivity is taken into account, it must pass through a maximum. If the effect of thermal conductivity or any kind of diffusion predominates, and if viscosity and Joule heat can be neglected, the aforementioned agreement is established without difficulty. In the case of a detonation, the process, by the way, twice passes through the Zhuge-point. The authors then carry out a qualitative investigation of several processes of the physical aspect of the structure of a vertical shock wave in magnetohydrodynamics. Here a new type of dissipation occurs which is due to Joule heat. Formulae for the discontinuity of entropy, for the estimation of Joule dissipation are written down. By measuring the course taken by the field in the shock wave by any inductive method, it is possible to estimate the conductivity of the medium. With increasing conductivity σ the thickness of the wave front decreases, but the field gradients increase to such an extent that the discontinuity of entropy depends solely on the discontinuity of the field strength. Also for the absorption coefficient of sound, which propagates in a direction that is vertical to the field in a medium of sufficiently

APPROVED FOR RELEASE: 08/25/2000 CIA-RDP86-00513R001652910013-3"

Some Remarks on the Structure of Shock Waves SOV/56-35-3-61/61

good conductivity, an expression is written down. The authors thank Ya. B. Zel'dovich and S. B. Pikel'ner for useful discussions. There are 4 references, all of which are Soviet.

ASSOCIATION: Vyssheye tekhnicheskoye uchilishche im. Baumana (Higher Technical School imeni Bauman)

SUBMITTED: June 9, 1958.

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SOV/26-58-12-5/44

AUTHORS: Stanyukovich, K.P., Professor, Golitsyn, G.S.

TITLE: Shock Waves (Udarnyye volny)

PERIODICAL: Priroda, 1958, 47, Nr 12, pp 33-38 (USSR)

ABSTRACT: The author gives an historical survey on the concept of shock waves, presents basic mathematical derivations and equations, and describes the appearance and utilization of shock wave phenomena in nature (thunder, novae, supernovae) and engineering (gun shells, bombs, percussion fuses, atomic bombs). A team of Soviet researchers under the direction of academicians L.A. Artsimovich and M.A. Leontovich found that magnetic fields, under the conditions of thermonuclear reactions, can assume the function of a piston in directed shock wave production, and thus may be useful for the materialization of a controlled thermonuclear reaction. Present scientific and technical progress points at an increasing universal utilization of shock waves for practical purposes.

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Shock Waves SOV/26-58-12-5/44

There are 5 diagrams, 1 graph and 4 Soviet references.

ASSOCIATION: Moskovskoye vyssheye tekhnicheskoye uchilishche im. N.E. Baumana (The Moscow Higher Technical School imeni N.E. Bauman)
Institut fiziki atmosfery Akademii nauk SSSR, Moskva (The Institute of the Physics of the Atmosphere of the AS USSR, Moscow)

Card 2/2

equation of state (adiabatic equation) $w = w(v)$ can be determined from the last mentioned equation and from another given equation of the dependences $a = a(r)$ and $w = w(r)$. The medium at $r=r_{min}$ has a critical flow velocity. Then the properties of the flow at $r \rightarrow \infty$ are investigated. Here obviously $v \rightarrow \infty$ holds and in the case of real equations of state the value of w decreases. The further calculations must then be carried out for a real adiabatic equation; the author here uses the equation pv^k = const. The given dependence $r = r(w)$ is put down explicitly. Then the equations for an ultrarelativistic gas are given. The author shows then that in a quasidimensional motion of the gas flow with variable cross sections a critical flow is present in the least cross section. Also the Bernoulli equation is determined and mentioned. Also the asymptotic dependences $v = v(r)$ and $p = p(r)$ are put down for an ultra relativistic gas. Finally the author gives a

Some Steady Relativistic Flows 20-119-2-15/60

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APPROVED FOR RELEASE: 08/25/2000 CIA-RDP86-00513R001652910013-3"

The Interaction Between Two Bodies "Radiating" Gas Flows

20-119-4-16/60

effuse the depth of their mutual penetration must be taken into account. Next, an expression for the velocity of effluence is derived. The interaction force between the bodies will be a force of attraction because the gas expands in a non-uniform manner. The case $M_1=M_2=M$ is the most interesting and can be studied with the greatest degree of accuracy. If a certain secondary condition given here is satisfied, the result does not depend on the criteria of the equality of pressure and forces. The surface of the "interaction" of flows is a plane. A certain difference in the numerical coefficient in the law of interaction can, in the case of dense flows, be explained by the lateral flow of the gases. In the case of not very dense flows, the depth of mutual penetration must be taken into account. These two factors may somewhat reduce the interaction force. After correct investigation of the case $M_1=M_2$, the case $M_1>M_2$ can be investigated by the usual methods of the potential theory. A formula for the interaction force is derived also for this general case. The here derived law

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AUTHOR: Stanyukovich, K. P. SOV/20-120-2-14/63

TITLE: Some Remarks on the High Velocity Motion of Bodies in a Weak Gravitation Field (Zamechaniya o dvizhenii tel s bol'shimi skorostyami v slabom pole tyazhesti)

PERIODICAL: Doklady Akademii nauk SSSR, 1958, Vol. 120, Nr 2, pp. 277-280 (USSR)

ABSTRACT: The equations $\partial T_{ik}/\partial x_k = f_i$ may be used for an approximate calculation of the relativistic motion of a solid body in the weak proper field. T_{ik} denotes the total energy-momentum tensor of the continuous medium and of the electromagnetic field, φ denotes the potential of the gravitation field, (in this paper it is assumed to be a scalar and not a tensor), v - the specific Volume, - an auxiliary potential). Neglecting the electromagnetic field, one may write $T_{ik} = (p+\mathcal{E})u_i u_k + \delta_{ik}p$.

An equation is next given for the potential of the gravitation field. Moreover, it is necessary to know the equation of state $p = p(v,T)$ or $p = p(\sigma,T)$ of the medium. T denotes the temperature and σ the entropy. A system of equations is then given for the case of adiabatic flow with central symmetry.

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Some Remarks on the High Velocity Motion of Bodies in a Weak Gravitation Field SOV/20-120-2-14/63

The author investigates the following problem: A certain volume of a medium with the mass M_0 explodes, and as a result, high energy is liberated; this marks the beginning of expansion. The energy density may be so high that the peripheral part of the expanding gas may attain velocities which are near the velocity of light. After a certain time, when the pressure in the interior of the expanding gas has decreased, it is possible to investigate the motion which is performed without influencing the internal pressure in the proper field of gravitation. The corresponding equations are given in an explicit form, after which they are transformed. It is very interesting to investigate the motion with spherical symmetry; the corresponding equation is given and analyzed. Different values of the initial velocity a_0 of the gas lead to different trajectories: In the case $a_0^2 < 0$ (elliptical case) the particles come to a standstill in a finite distance. In the case $a_0^2 = 0$ (parabolic case) the velocity of the particles becomes zero in an infinite distance. In the hyperbolic case $a_0^2 > 0$ the particles have a finite velocity in an infinite distance. The following cases are possible: After the explosion,

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Some Remarks on the High Velocity Motion of Bodies in a Weak Gravitation Field SOV/20-120-2-14/63

the gas remains at a finite distance and will fall to the center, after which the process of expansion begins anew, etc. Some particles may be involved in a pulsation process, remaining always within a finite distance; when the energy yield is extraordinarily high, all the particles may have the tendency to fly away into infinity. Finally, the authors investigate a concrete problem, the case of a hyperbolic motion and a weak field. There are 1 figure and 1 Soviet reference.

PRESENTED: January 17, 1958, by N.N. Bogolyubov, Member, Academy of Siences USSR

SUBMITTED: January 7, 1958

1. Mass-energy relation 2. Solids--Motion 3. Solids--Magnetic factors 4. Adiabatic gas flow--Analysis 5. Explosions--Analysis 6. Mathematics--Applications

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SOV/4693

Untrodden Paths of the Universe

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I. ASSAULT OF THE SKIES

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Slingukhovich, K.P.

PHASE I BOOK EXPLOITATION SOV/3839
SOV/58-M-24(31)

Vsesoyuznoye astronomo-geodezicheskoye obshchestvo

Byulleten', No. 24/31/, 1959 (Bulletin, No. 24/31/,1959) Moscow, Izd-vo AN SSSR, 1959. 77 p. 1,500 copies printed.

Sponsoring Agency: Akademiya nauk SSSR.

Ed. of Publishing House: K.P. Gurov; Tech. Ed.: G.A. Astaf'yeva; Editorial Board: V.V. Fedynskiy (Resp. Ed.), M.S. Bobrov (Deputy Resp. Ed.), M.M. Dagayev, I.T. Zotkin, A.A. Izotov, P.P. Parenago, P.I. Popov, V.A. Bronshten (Scientific Secretary).

PURPOSE: This publication is intended for astronomers, geophysicists, geodesists, and theoretical physicists.

COVERAGE; This issue of the Bulletin of the All-Union Astronomical and Geodetic Society contains articles on lunar and solar eclipses, photographic observation

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of Jupiter and Perseid, noctilucent clouds, a collimating view finder, and the modeling of lunar cirques. The Kuybyshev Astronomical Observatory is described in a separate article. References accompany individual articles.

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STANYUKOVICH, K.P.

PHASE I BOOK EXPLOITATION SOV/3405

Soveshchaniye po voprosam kosmogonii. 6th, Moscow, 1957

Vnegalakticheskaya astronomiya i kosmologiya; trudy soveshchaniya (Extragalactic Astronomy and Cosmology; Transactions of the 6th Conference on Problems of Cosmogony, June 5-7, 1957) Moscow, AN SSSR, 1959. 273 p. Errata slip inserted. 1,500 copies printed.

Sponsoring Agency: Akademiya nauk SSSR.

Ed. of Publishing House: L.V. Samsonenko; Tech. Ed.: G.N. Shevchenko; Editorial Board: D.A. Frank-Kamenetskiy (Resp. Ed.) Professor; B.A. Vorontsov-Vel'yaminov, Corresponding-Member.

PURPOSE: The book is intended for astronomers and physicists studying problems of general cosmology.

COVERAGE: The book is a collection of papers on cosmogony read by scientists participating in a conference held in Moscow on June 5-7, 1957. The papers review recent observational and theoretical work in extragalactic astronomy, gravitational theory, theory of relativity, red shift, radio astronomy, formation of chemical elements, thermodynamics of the universe, entropy, etc. No personalities are mentioned. There are references following most of the reports.

Stanyukovich, K.P.

16(1) PHASE I BOOK EXPLOITATION SOV/2660

Vsesoyuznyy matematicheskiy s"yezd. 3rd, Moscow, 1956

Trudy. t. 4: Kratkoye soderzhaniye sektsionnykh dokladov. Doklady inostrannykh uchenykh (Transactions of the 3rd All-Union Mathematical Conference in Moscow. vol. 4: Summary of Sectional Reports. Reports of Foreign Scientists) Moscow, Izd-vo AN SSSR, 1959. 247 p. 2,200 copies printed.

Sponsoring Agency: Akademiya nauk SSSR. Matematicheskiy institut.

Tech. Ed.: G.N. Shevchenko; Editorial Board: A.A. Abramov, V.G. Boltyanskiy, A.M. Vasil'yev, B.V. Medvedev, A.D. Myshkis, S.M. Nikol'skiy (Resp. Ed.), A.G. Postnikov, Yu. V. Prokhorov, K.A. Rybnikov, P. L. Ul'yanov, V.A. Uspenskiy, N.G. Chetayev, G. Ye. Shilov, and A.I. Shirshov.

PURPOSE: This book is intended for mathematicians and physicists.

COVERAGE: The book is Volume IV of the Transactions of the Third All-Union Mathematical Conference, held in June and July 1956. The book is divided into two main parts. The first part contains summaries of the papers presented by Soviet scientists at the Conference that were not included in the first two volumes. The second part contains the text of reports submitted to the editor by non-Soviet scientists. In those cases when the non-Soviet scientist did not submit a copy of his paper to the editor, the title of the paper is cited and, if the paper was printed in a previous volume, reference is made to the appropriate volume. The papers, both Soviet and non-Soviet, cover various topics in number theory, algebra, differential and integral equations, function theory, functional analysis, probability theory, topology, mathematical problems of mechanics and physics, computational mathematics, mathematical logic and the foundations of mathematics, and the history of mathematics.

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STANYUKOVICH, K.P.

16(1) PHASE I BOOK EXPLOITATION SOV/2660

Vsesoyuznyy matematicheskiy s"yezd. 3rd, Moscow, 1956

Trudy. t. 4: Kratkoye soderzhaniye sektsionnykh dokladov. Doklady inostrannykh uchenykh (Transactions of the 3rd All-Union Mathematical Conference in Moscow. vol. 4: Summary of Sectional Reports. Reports of Foreign Scientists) Moscow, Izd-vo AN SSSR, 1959. 247 p. 2,200 copies printed.

Sponsoring Agency: Akademiya nauk SSSR. Matematicheskiy institut.

Tech. Ed.: G.N. Shevchenko; Editorial Board: A.A. Abramov, V.G. Boltyanskiy, A.M. Vasil'yev, B.V. Medvedev, A.D. Myshkis, S.M. Nikol'skiy (Resp. Ed.), A.G. Postnikov, Yu. V. Prokhorov, K.A. Rybnikov, P. L. Ul'yanov, V.A. Uspenskiy, N.G. Chetayev, G. Ye. Shilov, and A.I. Shirshov.

PURPOSE: This book is intended for mathematicians and physicists.

COVERAGE: The book is Volume IV of the Transactions of the Third All-Union Mathematical Conference, held in June and July 1956. The book is divided into two main parts. The first part contains summaries of the papers presented by Soviet scientists at the Conference that were not included in the first two volumes. The second part contains the text of reports submitted to the editor by non-Soviet scientists. In those cases when the non-Soviet scientist did not submit a copy of his paper to the editor, the title of the paper is cited and, if the paper was printed in a previous volume, reference is made to the appropriate volume. The papers, both Soviet and non-Soviet, cover various topics in number theory, algebra, differential and integral equations, function theory, functional analysis, probability theory, topology, mathematical problems of mechanics and physics, computational mathematics, mathematical logic and the foundations of mathematics, and the history of mathematics.

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STANYUKOVICH, K.P.

PHASE I BOOK EXPLOITATION SOV/3793

Baum, Filipp Abramovich, Kirill Petrovich Stanyukovich, and Boris Isaakovich Shekhter

Fizika vzryva (Physics of Explosion) Moscow, Fizmatgiz, 1959. 800 p. 6,500 copies printed.

Eds.: I.Ya. Petrovskiy and Ye.B. Kuznetsova; Tech. Ed.: N.Ya. Murashova.

PURPOSE: This monograph is intended for specialists in the theory and use of explosives, and may prove useful to students and aspirants specializing in this field.

COVERAGE: The authors present a systematic up-to-date examination of the complex of problems concerning regularities of the transformations of explosives and explosive effect in various media. The overall properties of explosives and the conditions of their transformation as a function of various physical and chemical factors, detonation, and combustion processes are discussed. Problems of brisance are treated, and the theory of cumulation is examined in detail. Great attention is given to applied gas dynamics of unsteady flows.

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The present work is intended to fill a lacuna in the literature on explosion physics and processes taking place in the ambient medium during an explosion. The authors point out that the only authoritative textbooks on the subject, those of K.K. Snitko (1934 and 1936) and N.A. Sokolov, are out of date. Problems of nuclear explosions are not treated at all. Chapters I, II, IV, V, VI, VII, VIII were written by F.A. Baum; chapters XIII and XIV were written by K.P. Stanyukovich; chapters III, IX and XV were written by B.I. Shekhter. Chapters XI and XII were written jointly by Baum and Stanyukovich, section 46 by Shekhter, section 86 by Baum and Stanyukovich, and sections 98 and 87 by Baum and Shekhter. The supplement was written by Stanyukovich. The authors express thanks to M.A. Sadovskiy, A.S. Kompaneyts, and G.I. Pokrovskiy. References for each chapter appear at the end of the book.

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ORLENKO, L.P.; STANYUKOVICH, K.P.

Shock waves in solids. Izv.vys.ucheb.zav.; fiz. no.6:14-24 '59.
(MIRA 12:4)

1. Moskovskoye vyssheye tekhnicheskoye uchilishche im. Baumana.
(Shock waves)

STANYUKOVICH, K.P., doktor fiz.-mat. nauk

Look out for the astronauts, moon! IUn. nat. no.12:13-15 D '59
(Space flight to the moon) (MIRA 13:3)

STANYUKOVICH, K.P. (Moskva)

The physical nature of gravitation. Biul.VAGO no.24 '59.
(MIRA 13:4)
(Gravitation)

STANYUKOVICH, K., prof.

Who is really right? IUn. tekh. 4 no.10:47-48 O '59.
(MIRA 13:1)

(Cosmogony) (Stars--Spectra)

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3(1)

AUTHORS: Stanyukovich, K.P., Fedynskiy, V.V. SOV/33-36-2-26/27

TITLE: Review of the Book I. Yevgen'yev, L. Kuznetsova "After the Firestone" (Editor S. Prokhodtseva) M., Geografgiz, 1958, pp 214, Edition 50 000

PERIODICAL: Astronomicheskiy zhurnal, 1959, Vol 36, Nr 2, pp 380-381 (USSR)

ABSTRACT: The book deals with the history of the investigation of the gigantic meteorite which fell on June 30, 1908 into the basin of the river Podkamennaya Tunguska. The reviewers stress highly the dispassionate scientific description of the circumstances, especially the faithful report on the efforts of the Soviet scientist L.A. Kulik (follower of V.I. Vernadskiy).

SUBMITTED: January 20, 1959

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24(6)

AUTHOR: Stanyukovich, K. P. SOV/56-36-5-69/76

TITLE: On the Problem of the Impact of Solid Bodies With High Velocities (K voprosu ob udare tverdykh tel s bol'shimi skorostyami)

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1959, Vol 36, Nr 5, pp 1605-1606 (USSR)

ABSTRACT: In the present "Letter to the Editor" the author discusses the destruction of material when a solid obstacle is hit with great velocity by a solid body, and the propagation of the shock wave. At velocities of more than several km/sec a strong shock wave occurs in both the body mentioned and in the solid obstacle, on the front of which the crystal lattice structure of the material is destroyed; at a relative speed of $u_0 \gtrsim 10$ km/sec (e. g. when a meteorite hits the surface of the moon) matter evaporates on the shock wave front. With an increase of the distance from the shock center pressure decreases rapidly, evaporation is substituted by melting, and, finally matter is simply fragmentated; the latter effect no longer occurs if mass

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density at the shock wave front becomes less than the so-called "material strength" ε. In this respect such a shock process may be dealt with like an explosion of a high-explosive substance (e. g. trotyl); the equivalent mass of such an explosive may be given as amounting to $m_{expl} = \eta E_0/Q = \eta M_0 u_0^2/2Q$, where E_0 denotes the primary energy, M_0 the mass of the impinging body, η - the degree of efficacy, and Q the caloric equivalent of 1 g of exploding substance. If $u_0 > \sqrt{\varepsilon}$, it holds for the momentum projected on to the normal, that $J_0 = M_0 u_0 \cos\theta$ (θ denotes the angle of coincidence measured in the direction of the normal) and, as experiments and calculations show, the mass of the material slung away is $M \approx E_0/\varepsilon$, i. e. $J \approx \sqrt{ME_0}$, and further $J = BE_0/\sqrt{\varepsilon}$. The proportionality factor B is a material constant. The ratio $J_0/J = 2\cos\theta\sqrt{\varepsilon}/Bu_0$ is low (if $u_0 > \sqrt{\varepsilon}$), and therefore the influence on the angle of incidence in the case of large u_0 is practically negligible. At cosmic velocities (30 - 40 km/sec) J exceeds J_0 by several orders of magnitude. Only in the case of very large θ (i. e. in the case of a glancing hit) these considerations do not hold. There are 3 Soviet references.

SUBMITTED: February 17, 1959

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SOV/56-36-6-23/66

21(7)

AUTHOR: Stanyukovich, K. P.

TITLE: Cylindrical and Plane Magnetohydrodynamic Waves (Tsilindricheskiye i ploskiye magnitogidrodinamicheskiye volny)

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1959, Vol 36, Nr 6, pp 1782-1787 (USSR)

ABSTRACT: An investigation of plane and especially of cylindrical magnetohydrodynamic waves is of great interest both from the physical and from the analytical point of view. In the present paper the author deals with several problems relating to this subject and confines himself to the case of infinite conductivity and isentropic motion in a magnetic field which is perpendicular to the direction of motion. The investigations are first carried out in generally relativistic form (strong fields and high energy densities), after which "classical" and relatively weak fields are dealt with. Analysis is carried out for two cases, viz when the field direction coincides with the z-axis, and when it forms an angle with the latter. In part 1 the fundamental relations are established. Part 2 deals with the special case of a steady flow, and part 3 deals with the non-steady case. The fundamental equations of isentropic

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cylindrical waves in relativistically invariant form as formulated in part 1 in each case serve as a basis. In part 3 intense "sound" waves in an ultrarelativistic gas are investigated at flow velocities that are near the velocity of light ($1 - a/c \ll 1$), and also the case in which $a \approx c$. There is 1 Soviet reference.

ASSOCIATION: Vyssheye tekhnicheskoye uchilishche im. Baumana (Higher Technical School imeni Bauman)

SUBMITTED: December 13, 1958

PHASE I BOOK EXPLOITATION SOV/4946

Mikhaylov, A. A., ed.

Stantsii v kosmose; sbornik statey (Space Stations; Collection of Articles) Moscow, Izd-vo AN SSSR, 1960. 444 p. 25,000 copies printed. (Series: Akademiya nauk SSSR. Nauchno-populyarnaya Seriya)

Resp. Ed.: A. A. Mikhaylov; Compiler: V. V. Fedorov; Ed. of Publishing House: Ye. M. Klyaus; Tech. Ed.: I. D. Novichkova.

PURPOSE: This book is intended both for the space specialist and the average reader interested in space problems.

COVERAGE: The book contains 73 short articles by various Soviet authors on problems connected with space travel and the launching of artificial earth satellites and space rockets. Some possibilities of future developments are also discussed. The articles were published in the period of 1957-1960. No personalities are mentioned. There are no references.

STANYUKOVICH, K. P.

PHASE I BOOK EXPLOITATION SOV/4281

Akademiya nauk SSSR

Iskusstvennyye sputniki zemli, vyp. 4 (Artificial Earth Satellites, No. 4) Moscow, 1960. 205 p. Errata slip inserted. 6,500 copies printed.

Resp. Ed.: L.V. Kurnosova; Ed. of Publishing House: M.I. Fradkin; Tech. Ed.: T.P. Polenova.

PURPOSE: This collection of articles is intended to disseminate data collected in investigations performed by means of artificial earth satellites.

COVERAGE: The collection consists of 15 articles dealing with scientific data on Soviet artificial earth satellites (AES) and cosmic rockets. The topics discussed include measurements of the density of the upper atmosphere, motion of AES, measurements of micrometeorites and meteoric matter, magnetometric measurements of cosmic rays, electrical potential, and spectrum of positive ions. The collection is part of a series published regularly. References follow each article.

Yatsunskiy, I.M. Determination of the Conditions of Illumination and the Time Intervals in Which the Satellite Remains in Sunlight and in Shadow 35

The article discusses one of the possible methods of determining the conditions of illumination of satellites. The relative motion of the first, second, and third Soviet AES to the earth is briefly analyzed.

Eneyev, T.M., A.K. Platonov, and R.K. Kazakova. Determining Orbital Parameters of AES According to Ground Measurements 43

An abbreviated method of orbital parameter determination and forecasting of satellite motions is given. The method is based on data from the processing of optical and radiotechnical observations.

Taratynova, G.P. Methods of Numerical Solution of Equations in Finite Differences and Their Application to the Calculation of AES Orbits 56

The finite difference method is applied in the calculation of certain problems of celestial mechanics in the solution of systems of nonlinear differential equations determining the motion of AES in larger time intervals.

Lur'ye, A.I. Equation of Disturbed Motion in Kepler's Problem 82

Stanyukovich, K.P. Elements of the Shock Theory of Solid Bodies at High (Cosmic) Velocities 86

The author discusses the problems of shocks of meteorites at high (cosmic) velocity against the surface of a planet. This problem is related to the study of shocks of micrometeorites against the surface of AES

Mirtov, B.A. Meteoric Matter and Some Problems of Geophysics of the Upper Atmospheric Layers 118

The author attempts to connect phenomena occurring in the upper atmosphere with the presence there of particles of meteoric origin traveling at high velocities.

Dolginov, S.Sh., L.N. Zhuzgov, and V.A. Selyutin. Magnetometric Equipment of the Third Soviet AES 135

The working principle and installation of the magnetometric equipment on the AES are described. Characteristics of materials and the stability and precision of operation are discussed.

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Stanyukovich, K.P.

BARABASHOV, N.P.; BRONSHTEN, V.A.; ZEL'TSER, M.S.; KAYDANOVSKIY, N.L.; MARKOV, A.V., doktor fiziko-matemat.nauk; STANYUKOVICH, K.P.; SYTINSKAYA, N.N.; KHABAKOV, A.V.; ~~KHABIBULLIN, Sh.T.;~~ SHARONOV, V.V.; YAKOVKIN, A.A.; MANOVA, G.A., red.; MURASHOVA, N.Ya., tekhn.red.

[Moon] Luna. Pod red. A.V.Markova. Moskva, Gos.izd-vo fiziko-matem.lit-ry, 1960. 384 p. (MIRA 13:6)
(Moon)

Stanyukovich, K.P.

PHASE I BOOK EXPLOITATION SOV/4290
SOV/37-S-38

Akademiya nauk SSSR. Komitet po meteoritam

Meteoritika; sbornik statey, vyp. 18 (Meteoritics; Collection of Articles, No. 18) Moscow, AN SSSR, 1960. 1,200 copies printed.

Ed.: V.G. Fesenkov, Academician; Deputy Resp. Ed.: Ye.L. Krinov; Ed. of Publishing House: I.Ye. Rakhlin; Tech. Ed.: A.P. Guseva.

PURPOSE: This publication is intended for astrophysicists, astronomers, and geologists, particularly those interested in the study of meteorites.

COVERAGE: This collection of 26 articles on problems in meteoritics includes the Transactions of the Eighth Meteoritic Conference which took place in Moscow, June 3 - 5, 1958. An introductory article reviews recent progress in the field, particularly in the matter of determining the age of meteorites. Individual articles discuss the fall, physical and chemical properties, and age of meteorites. The danger presented by meteors to artificial earth satellites is discussed. V.G. Fesenkov describes the theory and adduces computations for

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determining the distribution of ozone in the atmosphere during lunar eclipses. References accompany individual articles.

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TRANSACTIONS OF THE EIGHTH METEORITIC CONFERENCE

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Meteoritics; Collection of Articles, No. 18 SOV/4290

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STANYUKOVICH, K. P., GOLITSYN, G. S., KULIKOVSKIY, A. G. (Moscow)

"Magnetohydrodynamics (Review)."

report presented at the First All-Union Congress on Theoretical and Applied Mechanics, Moscow, 27 Jan - 3 Feb 1960.

STANYUKOVICH, K. P. (Moscow)

"On the Impact of Solids at High Speeds."

report presented at the First All-Union Congress on Theoretical and Applied Mechanics, Moscow, 27 Jan - 3 Feb 1960.

STANYUKOVICH, K. P. and BRONSHTEN, V. A.

Formation of Lunar Craters and Bright Rays as a Result of Meteorite Impacts.

report presented at the International Symposium on the moon, held at the Pulkovo Observatory, Leningrad, USSR, 6-8 Dec 1960.

STANYUKOVICH, K.P. [Staniukovych, K.P.], doktor tekhn.nauk, prof.

Our rockets fly toward the moon. Znan.ta pratsia no.1: 10-11 Ja '60. (MIRA 13:5)
(Lunar probes)

STANYUKOVICH, K.P., prof.

Stars are calling. Izobr.i rats. no.1:15-17 Ja '60.
(MIRA 13:4)

(Space flight)

APPROVED FOR RELEASE: 08/25/2000 CIA-RDP86-00513R001652910013-3"

S/179/60/000/005/001/010
E032/E114

AUTHOR: Stanyukovich, K.P. (Moscow)

TITLE: On an Effect in the Aerodynamics of Meteors 13

PERIODICAL: Izvestiya Akademii nauk SSSR, Otdeleniye tekhnicheskikh nauk, Mekhanika i mashinostroyeniye, 1960, No 5, pp 3-8

TEXT: Meteor bodies begin to be strongly retarded and consequently emit radiation at altitudes of the order of 100 km or less. At these altitudes the mean free path of molecules in the atmosphere is of the order of a few cm or mm. It is therefore usually considerably greater than the linear dimensions of meteor bodies and hence it is possible to discuss the problem in terms of discrete collisions of the air molecules with the meteor. When the velocity of the meteor is large (18-20 km/sec) each air molecule striking the meteor will eject a large number of atoms or molecules from the crystal lattice of the meteor body. The surface of the meteor will thus give off not only evaporated material, but also fragments consisting of groups of bound particles of the lattice. This mechanism of ejection of matter from meteor bodies is used to derive expressions for the rate of heating and the retardation of

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On an Effect in the Aerodynamics of Meteors

the body during its motion through the atmosphere at the above altitudes. Relations are derived for the rate of loss of mass and the rate of decrease of the velocity of the meteor as a function of the physical parameters of the body and the surrounding medium. There are 4 Soviet references.

SUBMITTED: June 21, 1960

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STANYUKOVICH, K.P.

Effects of the fall of large meteorites (theses of a report).
Meteoritika no.18:19 '60. (MIRA 13:5)
(Meteorites)

PEREL'MAN, R., STANYUKOVICH, K. P.

Let's be optimistic! Znan.sila 35 no.7:38-40 Jl '60.
(MIRA 13:7)

(Space flight)

STANYUKOVICH, K.P., SHALIMOV, V.P.

Concerning the movement of the meteor bodies in the atmosphere of the Earth.

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"METEORITKA" (Meteorites-Studies) Issue no. 20 - 1961, sponsored by the "Committee on Meteorites" of the Soviet Academy of Sciences - Moscow - 1961, 208 pages, and containing Collected Works("Trudy") of the "9th Meteorite Conference Organized by the Committee on Meteorites of the Soviet Academy of Sciences" and Held in KIEV on 2-4 June 1960.

67891

10.2000(A)

S/020/60/130/06/019/059
B013/B007

~~21 (7)~~

AUTHORS: Skuridin, G. A., Stanyukovich, K. P.

TITLE: An Approximate Solution of a Problem Concerning the Motion of a Conductive Plasma

PERIODICAL: Doklady Akademii nauk SSSR, 1960, Vol 130, Nr 6, pp 1248 - 1251 (USSR)

ABSTRACT: Several authors developed a new method for the asymptotic integration of linear partial differential equations of the hyperbolic type and by using this method they determined asymptotic solutions for the equations of acoustics and for Maxwell equations. Other authors solved the dynamic problems of the elasticity theory by means of this method. The general idea of this general method, discussed in the present paper, in a linear hyperbolic differential equation (e.g. in a wave equation) is based upon the following: The endeavor is made approximatively to satisfy the initial equations by special selection of the functions, which means the solutions are sought in the form $u(x,y,z,t) = A(x,y,z)\exp\{i\omega[t - \Phi(x,y,z)]\}$, if $\omega \to \infty$. Thus, one obtains the known relations $\mathrm{grad}^2\Phi = 1/c^2$ and $2(\mathrm{grad}\, A\ \mathrm{grad}\, \Phi) + A\Delta\Phi = 0$, where $\Phi(x,y,z)$ denotes the eikonal

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An Approximate Solution of a Problem Concerning the Motion of a Conductive Plasma

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of the wave and $A(x, y, z)$ the amplitude of the oscillation. The compression shock of the unsteady wave front and the amplitude of "geometric approximation" are found to be identical. The physical interpretation of the asymptotic method in quasilinear and linear equations is, however, no longer so easy. However, also in this case several problems may be formally solved by this method. The authors of the present paper integrate the equation of plasma oscillations by means of this method: they investigate the motion of a gas in a medium with the finite conductivity σ. The medium is here assumed to satisfy the equation of state $P = Qe^{(S-S_0)/c_v} \gamma$. The corresponding system of equations of magneto-gas-dynamics in the onedimensional case is explicitly written down. The problem is reduced to the determination of the unknown quantities P, Q, H, and u (velocity of the gas) in a sufficiently general form, which means that these equations are to contain arbitrary functions which are then determined from the initial- and boundary conditions. The calculative solution of this problem is followed step by step. For the determination of Θ and u (where $\Theta = (\ln A)_x$ one obtains two

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arbitrary functions $T(t)$ and $F(\theta)$ and an arbitrary constant B. The authors then investigate the case $F(\theta) = \beta\theta$ with $\beta = const < 0$. For this case a rather lenghty expression is obtained for the magnetic field strength. Further, the final expressions for the density ϱ and the pressure P are obtained. The corresponding arbitrary functions are to be determined from the boundary conditions. The concrete solution of the problem presents no difficulties. There are 10 references, 6 of which are Soviet.

ASSOCIATION: Institut fiziki Zemli im. O. Yu. Shmidta Akademii nauk SSSR (Institute for the Physics of the Earth imeni O. Yu. Shmidt of the Academy of Sciences of the USSR)

PRESENTED: November 16, 1959, by N. N. Bogolyubov, Academician

SUBMITTED: October 22, 1959

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10.2000(A)

68807

AUTHORS: Skuridin, G. A., Stanyukovich, K. P. S/020/60/131/01/019/060 B013/B007

TITLE: The Motion of a Conductive Plasma Under the Effect of a Piston

PERIODICAL: Doklady Akademii nauk SSSR, 1960, Vol 131, Nr 1, pp 72 - 74 (USSR)

ABSTRACT: In the present paper the authors apply the general relations for the motion of a plasma determined in an earlier paper (Ref 1) to the following problem: A conductive medium (plasma) is assumed to move within a tube under the influence of a piston. The piston moves according to the law $x_p = at^2/2 = \psi(t)$. In this case $u_p^{(t)} = at = \dot{\psi}(t)$ holds for the speed of the piston. After a certain time, a shock wave develops before the piston. With a sufficiently high value of a, the shock wave occurs nearly immediately and near the origin of coordinates. The region of the motion of the medium until the development of a strong shock wave is neglected, for it is small and is of no essential importance. Next, the quantities occurring in the equation

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obtains $D_{front} = \frac{k+1}{2}at + \frac{(k^2-1)}{4\beta}\varkappa at^2$, and for the rate of flow of the gas behind the wave front $u_{back}(x,t) = at + \frac{(k-1)\varkappa at^2}{2\beta}$. For ϱ one finally finds

$$\varrho = \frac{k+1}{k-1}\sqrt{\frac{4\varkappa t + \beta}{4\varkappa t_0(z) + \beta}}\,\varrho_0.$$

Next, a rather long expression for P is determined. Thus, the problem of finding all parameters determining the motion of a conductive plasma under the influence of a piston is solved. There are 3 Soviet references.

ASSOCIATION: Institut fiziki Zemli im. O. Yu. Shmidta Akademii nauk SSSR (Institute of the Physics of the Earth imeni O. Yu. Shmidt of the Academy of Sciences of the USSR)

PRESENTED: November 16, 1959, by N. N. Bogolyubov, Academician

SUBMITTED: October 22, 1959

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31506

S/020/60/134/002/003/015
B104/B201

26.2331

AUTHORS: Levitin, L. B. and Stanyukovich, K. P.

TITLE: Linear approximation of velocity in the problem of linear motion of a plasma of finite conductivity

PERIODICAL: Doklady Akademii nauk SSSR, v. 134, no. 2, 1960, 300-303

TEXT: For their study, the authors proceeded from the equations

$$\begin{gathered}\frac{\partial\rho}{\partial t}+\frac{\partial}{\partial x}(u\rho)=0,\\ \frac{\partial u}{\partial t}+u\frac{\partial u}{\partial x}+\frac{1}{\rho}\frac{\partial p}{\partial x}+\frac{h}{\rho}\frac{\partial h}{\partial x}=0,\\ \frac{\partial p}{\partial t}+u\frac{\partial p}{\partial x}+kp\frac{\partial u}{\partial x}=(k-1)\varkappa\left(\frac{\partial h}{\partial x}\right)^2,\\ \frac{\partial h}{\partial t}+\frac{\partial}{\partial x}(uh)=\varkappa\frac{\partial^2 h}{\partial x^2}\end{gathered} \tag{1}$$

of magnetogas dynamics. This system describes the plane, linear motion in the case of a finite, constant conductivity which is strong enough to permit

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Linear approximation ...

displacement and convection currents to be neglected. $\vec{v} = (u,0,0)$, $\vec{H} = (0,H,0)$; $h = H/\sqrt{4\pi}$, $k = c_p/c_v$, $\varkappa = c^2/4\pi\sigma$, the magnetic viscosity. Owing to the great difficulties in finding exact solutions, much interest is attached to approximate solutions in which the plasma velocity $\vec{v}$ can be represented as a definite function. The authors briefly discuss results of M. A. Leontovich and S. M. Osovets (Atomnaya energiya, 3, 81 (1956)), K. P. Stanyukovich (Vvedniye v kosmicheskuyu gazodinamiku, M., 1958), and L. A. Artsimovich (Fizika plazmy i problema upravlyayemykh termoyadernykh reaktsiy, 2, M., 1958, page 87). As shown by experiments, an approximation of plasma velocity between the front of the shock wave and the magnetic piston is well possible by means of a linear function of x, the coefficients of which are time functions. The advantage of this approximation is that it is possible to obtain a sufficient number of arbitrary functions to satisfy the boundary conditions. Thus, velocity may be expressed by $u(x,t) = a(t)x + b(t)$ (2). With $h = \partial\varphi/\partial x$, the differential equation $\partial\varphi/\partial t + u\partial\varphi/\partial x = \varkappa\partial^2\varphi/\partial x^2$ (3) describes the magnetic field. Proceeding from the boundary and initial conditions

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where
$$h(X_n(t),\ t) = \mu(t);\quad h(x,\ 0) = 0, \tag{7}$$
and
$$X_n(t) = \exp\left(\int a\,dt\right)\int_0^t b(t)\exp\left(-\int a\,dt\right)dt \tag{8}$$

for the magnetic field in the problem of the magnetic piston, and from conditions

$$\rho_1(u_1 - D) = \rho_2(u_2 - D);$$
$$\rho_1(u_1 - D)^2 + p_1 + {}^1/_2 h_1^2 = \rho_2(u_2 - D)^2 + p_2 + {}^1/_2 h_2^2; \qquad (9)\text{-}(12)$$
$$\frac{k}{k-1}\frac{p_1}{\rho_1} + \frac{(u_1 - D)^2}{2} + \left[\frac{h_1}{\rho_1} - \frac{\varkappa}{\rho_1(u_1 - D)}\left(\frac{\partial h}{\partial x}\right)_1\right]h_1 =$$
$$= \frac{k}{k-1}\frac{p_2}{\rho_2} + \frac{(u_2 - D)^2}{2} + \left[\frac{h_2}{\rho_2} - \frac{\varkappa}{\rho_2(u_2 - D)}\left(\frac{\partial h}{\partial x}\right)_2\right]h_2;$$
$$(u_1 - D)h_1 - \varkappa\left(\frac{\partial h}{\partial x}\right)_1 = (u_2 - D)h_2 - \varkappa\left(\frac{\partial h}{\partial x}\right)_2.$$

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holding in the front of the shock wave, the authors derive expression,

$$h(x_0, t) = \frac{x_0}{2\sqrt{\pi\varkappa}\,A}\int_0^t \frac{\mu(q)}{A(q)\left(\int_q^t A^{-2}dq\right)^{3/2}} \exp\left(-\frac{x_0^2}{4\varkappa\int_q^t A^{-2}dq}\right)dq. \qquad (14)$$

for the magnetic field. Here $X_п(t)$ is the Euler coordinate of the piston (plasma boundary), $D = D(t) = dX_ф(t)/dt$ is the velocity of the shock-wave front. Further, $A(t)$ and $X_п(t)$ are taken as new approximating functions. Functions $a(t)$ and $b(t)$ are easily expressed by $a(t) = dA/Adt$; $b(t) = Ad(X_п/A)/dt$ (15). Expression

$$\rho_0 + \rho_0\frac{[(1-A)X_п' + A'X_п]^2}{(1-A)^3} + \frac{\rho_0}{2}\frac{A''X_п^2}{(1-A)^2} + \rho_0\frac{X_п''X_п}{1-A} = \frac{\mu^2(t)}{2}. \qquad (20)$$

is derived from an examination of equation (10) for the momentum equilibrium in the front, and equation

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$$\frac{\rho_0}{A} + \frac{k-1}{2k}\,\frac{\rho_0}{A}\,\frac{(1+A)\left[(1-A)X_n' + A'X_n\right]^2}{(1-A)^3} + \frac{\rho_0}{2}\,\frac{A'^2X_n^2}{(1-A)^2} + \frac{\rho_0 X_n'' X_n}{1-A} =$$
$$= \frac{\mu^2(t)}{2} + \left\{\left[Ah_3 - \frac{\varkappa A_2}{X_n'}\left(\frac{\partial h}{\partial x}\right)_2\right](1-A) + \frac{(A^3+1)\,h_2}{2}\right\}\frac{h_2}{\rho_0}. \qquad (21)$$

is found for the energy equilibrium. From (20) and (21) it is possible to determine b(t) and a(t) by the differential equations (15). Since the magnetic field behind the front influences the motion of the front only with very low t, expressions

$$X_\Phi(t) = \frac{X_n}{1-A} = \sqrt{2}\,c_0\int_0^t \frac{dt}{\sqrt{A(k+1)-(k-1)}}, \qquad (22)$$

are derived for the coordinates of the front, without considering the terms containing $h = H/\sqrt{4\pi}$. There are 8 references: 6 Soviet-bloc and 2 non-Soviet-bloc.

ASSOCIATION: Moskovskiy gosudarstvennyy universitet im. M. V. Lomonosova (Moscow State University imeni M. V. Lomonosov)

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Linear approximation ... S/020/60/134/002/003/025
B104/B201

PRESENTED: June 28, 1960, by N. N. Bogolyubov, Academician

SUBMITTED: April 28, 1960

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STANYUKOVICH, K.P.

PHASE I BOOK EXPLOITATION SOV/5757

Vasil'yev, Mikhail Vasil'yevich, and Kirill Petrovich Stanyukovich

V mire semi stikhiy (In a World of Seven Elements) [Moscow] Izd-vo Tsk VLKSM "Molodaya gvardiya," 1961. 254 p. 33,000 copies printed.

Eds.: V. Pekelis and V. Fedchenko; Tech. Ed.: L. Kuvyrkova.

PURPOSE: This book is intended to acquaint the general reader with modern problems of physics.

COVERAGE: The book discusses hydro- and gasdynamics, explosion theory, field dynamics, and other fields of physics which made possible the present advanced state of aviation, rocket and hydraulic engineering, thermal engines, etc. The book is written in popular form, but treats difficult problems, such as the mastering of ultrasonic speeds, flight outside the earth's atmosphere, construction of photon rockets, and interstellar flight. The book attempts to answer such questions as: are speeds faster than light

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STANYUKOVICH, K. P.

"Relativistic Gas Dynamics,"

report presented at the 5th Intl. Conference on Gas Dynamics, Jablonna, Poland. Sept. 1961.

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S/188/61/000/005/005/006
B114/B205

9,9867 (1534)

AUTHOR: Stanyukovich, K. P.

TITLE: Emission of gravitational waves by "elementary particles"

PERIODICAL: Moskovskiy Universitet. Vestnik. Seriya III. Fizika, astronomiya, no. 5, 1961, 71 - 82

TEXT: In general, gravitational waves are rather insignificant. However, in particular cases where a large amount of energy is transported by them, the gravitating bodies interact appreciably. A weakly radiating system with a gravitational quadrupole moment (binary stars, meson cloud revolving around a nucleon, etc.) emits the energy $-\dot{E}_g = \frac{G}{45c^5}(\dddot{D}_{\alpha\beta})^2$ (1) per unit time (Ref.1: Landau, L. D., and Lifshits, Ye. M. Teoriya polya - Field theory, izd.3, § 102. Fizmatgiz, 1959). G is the gravitational constant, and $D_{\alpha\beta}$ is the tensor of the quadrupole moment. If $D_{\alpha\beta}$ is a periodic function of time, one obtains $-\overline{\dot{E}}_g = \alpha Mc^2$ (3) for the time average, where M

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denotes the total mass of the bodies. After spherical coordinates have been introduced for two mass points m_1 and m_2, the expression

$$\alpha = \frac{32Gm_1^2m_2^2}{5cR^2(m_1+m_2)^2}\left(\frac{R\omega}{c}\right)^6 \qquad (5)$$

(m is the reduced mass) follows for α since $D_{\alpha\beta} = mr^2(3x_\alpha x_\beta - \delta_{\alpha\beta} x^2_{\gamma\gamma})$. The orbital radius R = const is calculated for Coulomb interaction between m_1 and m_2. Thus, one finds

$$\alpha = \frac{32GZ^8e^6}{5c^7R^8m_1m_2}, \qquad (7)$$

from which $\alpha \approx 10^{-35}\,\mathrm{sec}^{-1}$ follows for the proton-electron system. For a meson cloud ($m_2 = 0.15\,(m_1+m_2)$; m_1 is the nucleon mass; $R = 1.5\cdot10^{-14}$ cm) one obtains $\alpha = 7.5\cdot10^{-19}\,\mathrm{sec}^{-1}$, $\omega = 5.5\cdot10^{23}\,\mathrm{sec}^{-1}$. For a meson cloud revolving around an atomic nucleus, slight corrections result from the oscillations of the nuclear surface. By a direct calculation of the metric tensor g_{ik}

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for a meson cloud revolving in the yz plane, the following expression is obtained with $m_1 + m_2 = M$:

$$\alpha = \frac{4GM^3c^3\left(\frac{4m}{M}\right)^4}{5Z^2e^4\left[1+\sqrt{1+\frac{8m}{M}}\right]^6}, \qquad (19)$$

from which it follows that $\alpha = 7.5\cdot10^{-19}\,\mathrm{sec}^{-1}$, $R = 2.8\cdot10^{-14}$ cm, $\omega = 10^{24}$, and $\frac{m_1}{M} = \frac{1}{190}$. The energy emitted during one revolution is given by $E_g = \frac{\alpha}{\omega_0}Mc^2 \approx 1.5\cdot10^{-45}$ erg ($m_g \approx 2.10^{-66}$ g). According to the relation between the gravitational mass m_g and the radius, R_o, of the universe, following from cosmology or from the quantum theory of gravitation,

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$R_o \approx 3 \cdot 10^{28}$cm is found. Considering the energy of the gravitational field to be fluctuations of the electromagnetic field of the nucleon, a value already assumed by Eddington (Ref. 9, see below) is obtained from $\frac{E_g}{E_{el}} \simeq \frac{1}{\sqrt{N}} \approx 10^{-41}$ for the number, N, of nucleons in the universe. There are 9 references: 5 Soviet and 4 non-Soviet. The references to English-language publications read as follows: Eddington, A., Teoriya otnositel'nosti (Theory of Relativity, 1934); Bethe, H., Morrison, F. Elementarnaya teoriya yadra (Elementary nucle.r theory), IL, 1958; Yennie, D. R.; Levy, M. M., Raynvonhall, D. R., Sb. Protemy covremennoy fiziki (Problems of contemporary physics), IL, 1958; Bohr, Å., Sb. Problemy sovremennoy fiziki, no.9, IL 1955.

ASSOCIATION: Kafedra statisticheskoy fiziki i mekhaniki (Department of Statistical Physics and Mechanics) [Abstracter's note: Moscow University]

SUBMITTED: January 20, 1961

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E2d(v)/Flb(g)

S/534/61/000/020/001/002
D208/D301

AUTHORS: Stanyukovich, K.P., and Shalimov, V.P.

TITLE: On the motion of meteor bodies in the earth's atmosphere

PERIODICAL: Meteoritika, 1961, no. 20, 54-71

TEXT: The motion of meteor bodies in the earth's atmosphere is normally treated by two different methods, depending on the ratio of the mean free path of the air molecules at the given altitude to the linear dimensions of the body. If the ratio is large then one can consider individual collisions between the molecules and the body, while in the case of a small ratio, the hydrodynamic approximation may be employed and the medium may be considered continuous. A further effect which must be considered is the formation of a shock wave, for velocities in excess of, say, 10 km/sec. The present paper is divided into two parts: the first part is concerned with the motion of a meteor body before the appearance of the shock wave, while the second part is devoted to shock-wave effects. It is shown in the first part that the coefficient C_x in

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the usual aerodynamic relation

$$-M\frac{du}{dt} = \frac{C_x}{2} S\rho u^2. \quad (18)$$

X

(M - mass of the body, u - its velocity, S - the cross section and ρ - the density) is given by (in the case of iron).

$$C_x = 2 + 0{,}16 \cdot 106\left[\frac{9}{u} + 2{,}4 \cdot 10^{-12} u\right] \quad (24)$$

A general and more complicated formula which can be used with other materials is also given. The values of C_x obtained on the basis of the present theory are said to be larger than those predicted previously by other workers. This is in agreement with satellite data and means that the atmospheric density deduced previously from meteor observations may have been too high. In the second part of this paper the authors derive a number of formulae describing the shock-wave effects. The results obtained for iron are conveniently summarised in Fig. 3. This figure gives energy ($W.10^{-12}$ erg cm^{-2} sec^{-1}) versus altitude (H.km) plots for iron ($r_o = 10^2$ cm,

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u_o = 60 km/sec; angle between the vertical and the direction of motion ($\varphi = 72^o$). The curve designations are as follows: curve 1 - total energy received by the body, curve 2 , radiation from shock wave, curve 3 - aerodynamic heating, curve 4 - energy lost by evaporation. The phenomenon is seen to be equivalent to an "explosion", the energy involved being very large. There are 3 figures, 3 tables and 12 references: 11 Soviet-bloc (1 translated from English) and 1 non-Soviet-bloc. The reference to the English-language publication reads as follows: D.R. Davies, Proc. Roy. Soc. 61, 105, 1948. 4

(For Fig. 3 see Card 4)

Card 3/~~4~~ 3

25715
S/020/61/139/003/014/025
B104/B201

24.4400 2106 [redacted]

AUTHOR: Stanyukovich, K. P.

TITLE: One-dimensional adiabatic flows of an ultrarelativistic gas

PERIODICAL: Akademiya nauk SSSR. Doklady, v. 139, no. 3, 1961, 590-593

TEXT: Equations

$$\left(\frac{\partial u}{\partial s}+u\frac{\partial u}{\partial r}\right)\left(1+\frac{p}{\varepsilon}\right)+\frac{u}{\varepsilon}\frac{\partial p}{\partial s}+\frac{1+u^2}{\varepsilon}\frac{\partial p}{\partial r}=0; \qquad (1)$$

$$\frac{\partial \ln \varepsilon}{\partial \rho}+u\frac{\partial \ln \varepsilon}{\partial r}+\left(1+\frac{p}{\varepsilon}\right)\left(\frac{\partial u}{\partial r}+\frac{u}{1+u^2}\frac{\partial u}{\partial s}+\frac{Nu}{r}\right)=0; \qquad (2)$$

describe the relativistic motion of a medium with point symmetry. Here, $u = a/c\sqrt{1-a^2/c^2}$ denotes the four-velocity; a is the velocity; p is the pressure; $\varepsilon = \rho c^2$ is the energy density; ρ is the density of the medium; $ds = cdt\sqrt{1-a^2/c^2}$ is an interval; N = 0, 1, 2 correspond to plane,

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One-dimensional adiabatic flows... S/020/61/139/003/014/025
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cylindrical, and spherical waves. The adiabatic equation $\partial\sigma/\partial t + u\partial\sigma/\partial r = 0$, where s denotes the entropy, may, if the equation of state reads $pv^k = A(\sigma)$ (v being the specific volume), since $\varepsilon = c^2\beta(\sigma)p^{1/k} + p/(k-1)$, be written in the form

$$\frac{\varepsilon+p}{kp}\left(\frac{\partial p}{\partial s} + u\frac{\partial p}{\partial r}\right) = \frac{\partial\varepsilon}{\partial s} + u\frac{\partial\varepsilon}{\partial r}. \tag{6}$$

The system of differential equations (1), (2), and (6) fully describes the adiabatic flows of a relativistic gas. Here, $n \sim 1/v$ holds, where n is the particle number in the unit volume; in addition, the law of conservation

$$-\left(\frac{\partial \ln v}{\partial s} + u\frac{\partial \ln v}{\partial r}\right) + \frac{\partial u}{\partial r} + \frac{u}{1+u^2}\frac{\partial u}{\partial s} + \frac{Nu}{r} = 0, \tag{7}$$

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holds for the particle number. For the study of the motion of the medium in the ultrarelativistic case (6) holds automatically, since $p = (k-1)\varepsilon$, and it is sufficient to study the system (1)-(2). Introducing $p^{*} = \ln p^{(k-1)/k}$; $\operatorname{sh}\omega = u$; where $ds = d\tau/\operatorname{ch}$, where $\tau = ct$, this system can be written in the form

$$\frac{\partial\omega}{\partial\tau} + \operatorname{th}\omega\,\frac{\partial\omega}{\partial r} + \frac{\partial p^{*}}{\partial r} + \operatorname{th}\omega\,\frac{\partial p^{*}}{\partial\tau} = 0, \tag{10}$$

$$\frac{\partial p^{*}}{\partial\tau} + \operatorname{th}\omega\,\frac{\partial p^{*}}{\partial r} + (k-1)\left[\frac{\partial\omega}{\partial r} + \operatorname{th}\omega\,\frac{\partial\omega}{\partial\tau} + \frac{N}{r}\operatorname{th}\omega\right] = 0. \tag{11}$$

which is solved by the method of characteristics. As to equations

$$\frac{dr}{d\tau} = \frac{a/c \pm \sqrt{k-1}}{1 \pm \sqrt{k-1}\,a/c}; \tag{12}$$

$$d\left[\ln p\left(\frac{1+a/c}{1-a/c}\right)^{\pm k/2\sqrt{k-1}}\right] = -\frac{kN\,d\tau}{r}\,\frac{a/c}{1 \pm \sqrt{k-1}\,a/c}. \tag{13}$$

(12) expresses a line, along which (13) is satisfied. For N = 0, (10) and (12) possess exact solutions for the one-dimensional motion of a gas. These solutions are found by two different methods in ordinary coordinates and in Lagrangian coordinates. In the former case it is assumed that $\partial(p^*,\omega)/\partial(\tau;\ x) \neq 0$. where x = r. The system of equations

$$\operatorname{th}\omega\left(\frac{\partial x}{\partial \omega}+\frac{\partial \tau}{\partial p^*}\right)=\frac{\partial \tau}{\partial \omega}+\frac{\partial x}{\partial p^*}; \qquad (14)$$

$$\frac{\partial x}{\partial \omega}+(k-1)\frac{\partial \tau}{\partial p^*}=\operatorname{th}\omega\left(\frac{\partial \tau}{\partial \omega}+(k-1)\frac{\partial x}{\partial p^*}\right). \qquad (15)$$

is obtained for (10) - (11). For the solution in Lagrangian coordinates, the system of equations (10) - (11) is written in the form

$$\frac{\partial \omega}{\partial \tau}+\frac{1}{\partial r/\partial r_0}\frac{\partial p^*}{\partial r_0}\,\frac{1}{\operatorname{ch}^2\omega}+\operatorname{th}\omega\,\frac{\partial p^*}{\partial \tau}=0; \qquad (23)$$

$$\frac{1}{k-1}\,\frac{\partial p^*}{\partial \tau}+\frac{1}{\partial r/\partial r_0}\frac{\partial \omega}{\partial r_0}\,\frac{1}{\operatorname{ch}^2\omega}+\operatorname{th}\omega\,\frac{\partial \omega}{\partial r}+\operatorname{th}\omega\,\frac{N}{r}=0. \qquad (24)$$

STANYUKOVICH, K.P.

Self-similar relativistic movements in the case of point symmetry.
Dokl. AN SSSR 140 no.1:77-80 S-O '61. (MIRA 14:9)

1. Moskovskoye vyssheye tekhnicheskoye uchilishche im. N.E.Baumana.
Predstavleno akademikom N.N.Bogolyubovym.
(Gas dynamics)

S/020/61/140/003/012/020
B104/B138

AUTHORS: Stanyukovich, K. P., and Bronshten, V. A.

TITLE: Velocity and energy of the Tunguska meteorite

PERIODICAL: Akademiya nauk SSSR. Doklady, v. 140, no. 3, 1961, 583-586

TEXT: The energy of the meteorite that fell on June 30, 1908 in Tunguska was estimated to have been about 10^{23} erg (K. P. Florenskiy, Yu. M. Yemel'yanov et al., Meteoritika, 19 (1960); M. A. Tsikulin, v. 6, Izd. Sib. otd. AN SSSR, 1959; Ye. L. Krinov, Tungusskiy meteorit, Izd. AN SSSR, 1949). V. A. Bronshten estimated the mass of the meteor at some 10^5-10^7 tons, its initial velocity v_0 to be about 11-46 km/sec, and its aerodynamic drag to be $c_x/2 = 0.5$-2 (Meteoritika, 20, (1961)). V. G. Fesenkov (Meteoritika, 12, 72 (1955)) using quite a different method found a mass of 10^6-10^7 tons. Z. Ceplecha (Bull. Astr. Inst. of Czechoslovakia, 11, no. 1 (1959)) showed that for large meteors the aerodynamic drag is $c_x/2 = 0.43$. Taking this value for the meteor studied, the authors ob-

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tained for an initial velocity of 35-43 km/sec, an initial mass 10^6 tons, a final velocity of 30 km/sec, and a final mass of $2\cdot10^4$ tons. The temperature of the shock wave front which the meteor produced when entering the Earth's atmosphere was calculated to have been 70,000 to 100,000°C. In this connection the authors point out an error in a work by A. V. Zolotov (DAN, 136, no. 1 (1961)). The heat balance equation for the meteor is established. By means of this equation it is demonstrated that an iron or a stone meteor of the mass in question, when entering into the Earth's atmosphere, gains heat down to an altitude of about 18 km, after which it begins to cool. According to I. S. Astapovich and Whipple, the core of a comet consists of a conglomerate of solid methane and ammonium with stone lumps and powder. The energy which such an ice block of 10^3 cm radius and 60 km/sec speed loses due to evaporation is less than the energy the body acquires from the shock wave. This leads to a rapid heating of the interior. About 30% of the total mass is vaporized in 0.2 sec. When this process is fast enough, the vaporized particles may form a strong spherical shock wave that will be like a protracted explosion. At $v = 30$ km/sec, the strength of this process is $2\cdot10^{13}$ erg/g·sec. This value has the order of magnitude of the estimates previously mentioned

S/020/61/140/003/012/020
B104/B138

Velocity and energy of the ...

(K. P. Stanyukovich, and V. P. Shalimov, Meteoritika, 20, (1961)). V. G. Fesenkov (Meteoritika, 22 (in print)) assumes that the comet core consists of closely packed small bodies. In this case, each of the small bodies would cause a shock wave, so that the comet would be destroyed before reaching the Earth's surface. A. V. Voznesenskiy and L. A. Kulik are mentioned. Academician V. G. Fesenkov is thanked for discussions. There are 1 figure, 1 table, and 13 Soviet-bloc references.

ASSOCIATION: Komitet po meteoritam Akademii nauk SSSR (Committee for Meteorites of the Academy of Sciences USSR)

PRESENTED: May 8, 1961, by V. G. Fesenkov, Academician

SUBMITTED: May 5, 1961

Card 3/3

PEREL'MAN, Roman Grigor'yevich; STANYUKOVICH, K.P., prof., otv. red.; PROKOF'YEVA, N.B., red. izd-va; GOLUB', S.P., tekhn. red.

[Engines of galactic ships]Dvigateli galakticheskikh korablei. Moskva, Izd-vo Akad. nauk SSSR, 1962. 197 p. (MIRA 15:9)
(Spaceships—Propulsion systems)

Stanyukovich, K.P. PHASE I BOOK EXPLOITATION SOV/6201

25

Vsesoyuznyy s"yezd po teoreticheskoy i prikladnoy mekhanike. 1st, Moscow, 1960.

Trudy Vsesoyuznogo s"yezda po teoreticheskoy i prikladnoy mekhanike, 27 yanvarya -- 3 fevralya 1960 g. Obzornyye doklady (Transactions of the All-Union Congress on Theoretical and Applied Mechanics, 27 January to 3 February 1960. Summary Reports). Moscow, Izd-vo AN SSSR, 1962. 467 p. 3000 copies printed.

Sponsoring Agency: Akademiya nauk SSSR. Natsional'nyy komitet SSSR po teoreticheskoy i prikladnoy mekhanike.

Editorial Board: L. I. Sedov, Chairman; V. V. Sokolovskiy, Deputy Chairman; G. S. Shapiro, Scientific Secretary; G. Yu. Dzhanelidze, S. V. Kalinin, L. G. Loytsyanskiy, A. I. Lur'ye, G. K. Mikhaylov, G. I. Petrov, and V. V. Rumyantsev; Resp. Ed.: L. I. Sedov; Ed. of Publishing House: A. G. Chakhirev; Tech. Ed.: R. A. Zamarayeva.

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PURPOSE: This book is intended for scientific and engineering personnel who are interested in recent work in theoretical and applied mechanics.

COVERAGE: The articles included in these transactions are arranged by general subject matter under the following heads: general and applied mechanics (5 papers), fluid mechanics (10 papers), and the mechanics of rigid bodies (8 papers). Besides the organizational personnel of the congress, no personalities are mentioned. Six of the papers in the present collection have no references; the remaining 17 contain approximately 1400 references in Russian, Ukrainian, English, German, Czechoslovak, Rumanian, French, Italian, and Dutch.

TABLE OF CONTENTS:

SECTION I. GENERAL AND APPLIED MECHANICS

APPROVED FOR RELEASE: 08/25/2000 CIA-RDP86-00513R001652910013-3"

34275

S/188/62/000/001/007/008
B114/B138

9,9867 (1538,1057)

AUTHOR: Stanyukovich, K. P.

TITLE: Interaction of bodies emitting gravitational waves (II)

PERIODICAL: Moscow. Universitet. Vestnik. Seriya III. Fizika, astronomiya, no. 1, 1962, 78 - 90

TEXT: Gravitational quadrupole radiation was discussed in Part I (Ref. 1. Vestn. Mosk. un-ta, ser. fiziki, astronomii, no. 5, 1961). Here, gravitational attraction between particles and bodies is treated as a graviton gas effect (Refs. 2 and 3: Ivanenko, D. D. and Sokolov, A. A., Klassicheskaya teoriya polya (Classical field theory), §56, Gostekhizdat, M., 1951, and Kvantovaya teoriya polya (Quantum-field theory), part 2, chapt. 2; Gostekhizdat, M., 1952). If p_o denotes the initial pressure of the graviton gas, then

$$p(r_1) = p_o \left(\frac{\alpha \delta_o v_o R_o^3}{3cr_1^2} \right)^2 ,$$

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where α is the loss of mass per unit of time and mass due to gravitational radiation, v_o is the initial specific volume, R_o and δ_o are the radius and density of the body, $M = \frac{4}{3}\pi\delta_o R_o^3$, and r denotes the position. From this and from $p = Av^{-4/3} \sim T^4$, $p = \frac{F(r_1 - ct)}{r_1^4}$, one obtains $T \sim \frac{1}{r_1}$ for the temperature of the graviton gas. The number of gravitons per unit volume is given by $n = \frac{3}{4\pi r_o^3}$ or 10^{38} cm^{-3} for $r_o = 10^{-13}$ cm, from which $\lambda_{grav.} = 3.10^{-14}$ cm follows. It is shown that the graviton gas is in thermal equilibrium and that gravitational attraction F is produced by exchange of gravitons. A straightforward calculation gives $F = \frac{GM^2}{r^2}$, where $G = \frac{\alpha^2 v_o}{24\pi}$. Thus one has $\alpha = \frac{4\pi cr}{Mv_o}$ or $\frac{6GM}{cr_o^2}$, and the mean free path for gravitons is found to be $\sim 10^{-13}$ cm. For a nucleon one has $\alpha = 10^{-15}$ sec^{-1}.

$v_o = 0.5.10^{25}$ cm^{3}g^{-1}, and the graviton rest mass turns out to be $1.67.10^{-66}$ g; a value given also by K. N. Savchenko (Ref. [illegible] astronomicheskoy observatorii", Vol. 2, no. 1, 1949). It is shown that the Newtonian law car also be derived for more than two bodies. The interval ds^2 for the field of an arbitrary number of particles is expressed in the form of the interval of one particle. The principal conclusion is that in first approximation, gravitational waves emitted by quadrupole moments lead to Newtonian attraction. Gravitation is regarded as being always of a wave-field nature, and the attraction of macroscopic bodies as the stationary case [Abstracter's note: This conclusion was drawn far earlier by de Broglie in Paris, and by Scotti and Cap, Innsbruck 1954, including the spin dependence of stationary gravitational fields.] M. P. Bronshteyn is mentioned as having proved the quantization of free gravitational fields. There are 6 references: 5 Soviet and 1 non-Soviet.

ASSOCIATION: Kafedra statisticheskoy fiziki i mekhaniki (Department of Statistical Physics and Mechanics)

SUBMITTED: January 20, 1961 (initially), July 10, 1961 (after revision)

APPROVED FOR RELEASE: 08/25/2000 CIA-RDP86-00513R001652910013-3"

KAPLAN, S.A., doktor fiz.-mat. nauk, red.; KIRKO, I.M., doktor fiz.-mat. nauk, red.; STANYUKOVICH, K.P., doktor fiz.-mat. nauk, red.; SHIROKOV, M.F., doktor fiz.-mat. nauk, red.; FRANK-KAMENETSKIY, D.A., doktor fiz.-mat. nauk, red.; VENGRANOVICH,A., red.; LEMBERG, A., tekhn. red.

[Problems of magnetohydrodynamics and plasma dynamics; reports] Voprosy magnitnoi gidrodinamiki i dinamiki plazmy; doklady. Riga, Izd-vo Akad. nauk Latviiskoi SSR. Vol.2. 1962. 660 p. (MIRA 15:12)

1. Soveshchaniye po teoreticheskoy i prikladnoy magnitnoy gidrodinamike. 2d, Riga, 1960.
(Magnetohydrodynamics) (Plasma (Ionized gases))

STANYUKOVICH, K.P. (Moskva)

Variation of arbitrary constants in "self-modeling solutions."
Inzh.zhur. 2 no.2:355-358 '62. (MIRA 15:6)
(Gas dynamics)

P/033/62/014/003/009/011
D237/D308

AUTHOR: Stanyukovich, K. P. (Moscow)

TITLE: Investigation of plane and cylindrical waves in the medium with finite conductivity

PERIODICAL: Archiwum Mechaniki Stosowanej, v. 14, no. 3-4, 1962, 683-688

TEXT: The initial equations for the case of ideal gas and central symmetry are simplified and one of them is reduced to

$$\frac{\partial \varphi}{\partial t} + u\frac{\partial \varphi}{\partial x} = \varkappa \frac{\partial^2 \varphi}{\partial x^2} \qquad (18)$$

which is solved approximately in general form by a method due to G. A. Skuridin and the author. Another method applied here to the magnetic piston problem consists in putting u = a(t) x + b(t) and introducing Lagrangian coordinates together with a normalized time-scale, which reduces the equation to that of heat conduction.

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P/033/62/014/003/011/011
D234/D308

AUTHOR: Stanyukovich, K. P. (Moscow)

TITLE: Relativistic motion of a medium and transition to radiation

PERIODICAL: Archiwum Mechaniki Stosowanej, v. 14, no. 3-4, 1962, 719-729

TEXT: The author points out that gravitational radiation due to self-oscillations of nucleons is considerable. The space between any two bodies is filled by radiation and the force acting on the bodies owing to radiation pressure is found to be inversely proportional to the square of the distance between them. This force is necessarily attractive, and is assumed to be the gravitational force. The basic theories of this paper have been published in previous papers by the author.

ASSOCIATION: Universitet im. Lomonosova, Moskva, Fizicheskiy fakul'tet (University im. Lomonosov, Moscow, Faculty of Physics)

Card 1/1

STANYUKOVICH, K.P.

Interaction of bodies emanating gravitational waves. Vest. Mosk. un. Ser.3: Fiz., astron. 17 no.1:78-90 Ja-F '62. (MIRA 15:2)

1. Kafedra statisticheskoy fiziki i mekhaniki Moskovskogo gosudarstvennogo universiteta.
(Gravitation)

24.1200

S/056/62/043/001/029/056
B104/B102

AUTHOR: Stanyukovich, K. P.

TITLE: Adiabatic one-dimensional motions of an ultrarelativistic gas

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 43, no. 1(7), 1962, 199 - 204

TEXT: It is shown that the equation derived by I. M. Khalatnikov (ZhETF, 27, 529, 1954) for the isentropic one-dimensional motion of an ultrarelativistic gas can be generalized for adiabatic motions in the case where the chemical potential is non-vanishing. Problems with constant or variable number of particles can be studied. The author proceeds from his equations

$$3\frac{\partial^2\chi}{\partial\eta^2} = 2\frac{\partial\chi}{\partial y} + \frac{\partial^2\chi}{\partial y^2}, \quad y = \ln T, \quad \eta = \overset{\text{arctan } a}{\cancel{\text{arctha}}}, \quad a = \text{velocity} \qquad (1)$$

$$\tau = e^{-\nu}\left(\frac{\partial\chi}{\partial y}\operatorname{ch}\eta - \frac{\partial\chi}{\partial\eta}\operatorname{sh}\eta\right), \quad x = e^{-\nu}\left(\frac{\partial\chi}{\partial y}\operatorname{sh}\eta - \frac{\partial\chi}{\partial\eta}\operatorname{ch}\eta\right) \qquad (2),$$

derived independently of Khalatnikov, and shows that the motion of

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S/020/62/145/001/006/018
B104/B102

24.4200

AUTHOR: Stanyukovich, K. P.

TITLE: The Lagrangian in the relativistic mechanics of continua

PERIODICAL: Akademiya nauk SSSR. Doklady, v. 145, no. 1, 1962, 59-62

TEXT: A study of potential motions in a continuum leads to the following expressions for the heat content W and the Lagrangian L of an ideal continuum in the relativistic case:

$$W^2 = -c^2\left(\frac{\partial S}{\partial x_i}\right)^2 = \dot{S}^2 - c^2 S_\alpha^2, \qquad (6)$$

$$W = ic\sqrt{(\partial S/\partial x_i)^2} = \sqrt{-c^2 S_\alpha + \dot{S}^2},$$

$$L = \frac{ic\sqrt{(\partial S/\partial x_i)^2} - E}{V} = \frac{\sqrt{-c^2 S_\alpha^2 + \dot{S}^2} - E}{V}. \qquad (7).$$

The continuity equation has the following form:

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B104/B102

The Lagrangian in the relativistic...

$$\left(1-\frac{\omega^2}{c^2}\right)\frac{\partial \ln W}{\partial x_k}\frac{\partial S}{\partial x_k}+\frac{\omega^2}{c^2}\frac{\partial^2 S}{\partial x_k^2}=0. \qquad (10);$$

$L = p = (W - E)/V$; S - potential; $\frac{d \ln W}{d \ln V} = -\frac{\omega^2}{c^2}$. A relativistic vortex motion of an ideal continuum can be completely described by (6) and (10). Equation (10) is brought to a form that makes it well adapted for using the method of characteristics. Finally, it is shown that in the ultra-relativistic case not only isentropic but also adiabatic flows have a potential.

ASSOCIATION: Vsesoyuznyy nauchno-issledovatel'skiy institut elektromekhaniki (All-Union Scientific Research Institute of Electromechanics)

PRESENTED: February 19, 1962, by N. N. Bogolyubov, Academician

SUBMITTED: February 17, 1962

Card 2/2

STANYUKOVICH, K. P.

On the possible variation of the gravitational constant.
Dokl. AN SSSR 147 no.6:1348-1351 D '62. (MIRA 16:1)

1. Nauchno-issledovatel'skiy institut elektromekhaniki.
Predstavleno akademikom N. N. Bogolyubovym.

(Gravitation)

BRONSHTEN, Vitaliy Aleksandrovich; STANYUKOVICH, K.P., doktor tekhn. nauk, prof., otv. red.; MAKOGONOVA, I.A., tekhn. red.; ZUDINA, V.I., tekhn. red.

[Problems of the motion of large meteorites in the atmosphere] Problemy dvizheniia v atmosfere krupnykh meteoritnykh tel. Moskva, Izd-vo AN SSSR, 1963. 122 p. (MIRA 16:12)
(Meteorites)

STANYUKOVICH, K.P.; BRONSHTEN, V.A.

Interstellar flights. Kosmos no.1:3-24 '63. (MIRA 16:8)

(Space flight)

S/040/63/027/001/013/027
D251/D308

AUTHORS: Levitin, L.B., Skuridin, G.A. and Stanyukovich, K.P. (Moscow)

TITLE: On the oscillations of an elastic inhomogeneous layer with a curvilinear boundary lying on an elastic inhomogeneous half-space

PERIODICAL: Prikladnaya matematika i mekhanika, v. 27, no. 1, 1963, 116-125

TEXT: An approximate solution is sought of the above problem which is of considerable importance to seismic investigations. The elastic layer is taken to be of variable height, and transverse elastic oscillations in a vertical plane through the layer are discussed. The boundary conditions are expressed in terms of Lame parameters. The solutions of equations of the oscillations are sought by means of the asymptotic method. It is shown that the solutions will be of the form

$$u_1(x,v,t) = A(x,v,\omega) \cos [\alpha(x)(v \mp h)] e^{i\omega S(x,t)}, \quad (1.6)$$

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S/020/63/148/002/021/037
B125/B112

AUTHOR: Stanyukovich, K. P.

TITLE: A generalization of Einstein's gravitational equations

PERIODICAL: Akademiya nauk SSSR. Doklady, v. 148, no. 2, 1963, 321-324

TEXT: This is an attempt to generalize the basic equation $R_i^k - (1/2)\delta_i^k R = \varkappa T_i^k$ by substituting the function $\varkappa = \varkappa(g_{ik}; R; x^i)$ for the gravitational constant $\varkappa$. Variation of the scalar $R^k = B^{ik}R_{ik}$ (energy density) and use of the equation $(R_i^k - (1/2)\delta_i^k R)_{jk}=0$ give

$$\frac{1}{\sqrt{-g}} \frac{\partial \sqrt{-g}\, A_i^r (T_r^k + t_r^k)}{\partial x^k} - \frac{A_r^l}{2} (T^{kr} + t^{kr}) \frac{\partial g_{kl}}{\partial x^l} + \psi_{i;\,k}^k = 0, \qquad (15)$$

from which the equation $A_i^r \partial(\sqrt{-g}\, T_r^k)/\partial x^k = (A_r^l/2)\sqrt{-g}\, T^{kr}\partial g_{kl}/\partial x^i$ is derived by means of the law of conservation of the four-momentum. The

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APPROVED FOR RELEASE: 08/25/2000 CIA-RDP86-00513R001652910013-3"

tensor A_i^r generalizes the "gravitational constant" $\varkappa$. T_r^k is the energy - momentum tensor. The set of equations derived here is complete and determines the components of the tensors T_i^k, t_i^k (energy - momentum pseudotensor), A_i^k, and g_{ik}. In the case $\varkappa \neq$ const, the basic equation is reduced to

$$R_i^k - {}^1/_2\delta_i^k R = \varkappa\,(T_i^k + t_i^k) - \delta_i^k R \frac{\partial \ln \varkappa}{\partial \ln g}. \quad (22).$$

From the formulation $\varkappa = \theta\ (g_{ik}) f(x^i;\ R)$, a set of equations is derived for the determination of θ, f, and the 10 components of t_i^k. The latter divide into two groups each having 5 components which describe the field of a particle with spin 2. According to the formalism developed here, the law of energy - momentum conservation is possible only at $\varkappa \neq 0$. The generalized Einstein equation may also be applied to cosmology.

ASSOCIATION: Vsesoyuznyy nauchno-issledovatel'skiy institut elektromekhaniki (All-Union Scientific Research Institute of Electromechanics)

A generalization of Einstein's ...

S/020/63/148/002/021/037
B125/B112

PRESENTED: July 28, 1962, by N. N. Bogolyubov, Academician

SUBMITTED: July 27, 1962

Card 3/3